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BACTERIAL AEROPLANKTON OF THE UPPER LAYERS OF THE ATMOSPHERE DURING THE WINTER

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FOREWORD

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/Following is a translation of an article by S. D. Klyuzko, Ya. G. Kishko and Yu. I. Vershchanskiy in the Russian-language periodical Vrachebnoye Delo (Medical Practice), Kiev, No. 1, 1960, pp. 75-76./

Bacteria and fungi in an aerosol state easily saturate air in motion and are then carried great distances in both horizontal and vertical directions.

However questions of the dispersal of microbes in the atmosphere, and their occurence and viability in the upper layers of the atmosphere have been studied very little, particularly with regard to different mateorological situations and at different seasons of the year. Yet these are precisely the questions of interest with regard to the carrying of microbes at great distances and which are of significance for public health and of general biological value.

We undertook an investigation for the purpose of studying the microflora of the upper atmosphere during the winter, taking into consideration the nature of the air masses. The work is a continuation of research started in 1957.

The selection of air samples from the "LI-2" airplane probe at an altitude of 100 to 6000 meters and over has been carried out in accordance with the method proposed by YA. G. Kishko. /See note./ 12 flights were made in March 1958. (Laboratornoye delo, no. 5, 1959).

Methodological data were interpreted on the basis of processed meterograms and data from aerologists on board the plane, and the nature of the air masses was determined on the basis of erological and synoptic maps of aeronautic meteorological stations. A study was made of the total number of micro-organisms and the different species involved, hemolytic cocci and anaerobic and thermophil micro-organisms. A total of 530 samples of the upper atmosphere were taken.

As shown by the studies, there is the greatest microflora content in the layer of air adjacent to populated sites at a height of up to 500 meters with an average of 494-383 microbes per cubic meter of air. As the altitude increases the bacterial content decreases evenly and at an altitude of 6000 meters there were only 1/8 as many as at the 100-2500 meter level. In addition, in the summer and fall the degree of bacterial dispersion in the upper air decreased sharply

with altitude, by leaps at altitudes of 500, 2000 and above 4000 meters while at an altitude of 7000 meters and over this drop was a hundredfold.

The observations made also revealed the influence of meterological factors on the resistance of bacterial aeroplankton. It was found that up to 2000 meters the number of microbes in the air increased when the relative humidity increased to 90%. For instance, at a height of 1000 meters with a humidity of up to 50% there was an average of 70 bacteria per cubic meter of air, with a humidity of 51-70% there were 133, and with a humidity of 71-90% there were 317. However, at heights of 4000 and 6000 meters the relationship was different: bacterial dispersion in the upper air decreased as the saturation of water vapor increased. It is likely that in more rarified air the bacterial aerosol resulting from the condensation of water vapors settles more rapidly because of increasing gravity.

The period of observations in the latitude of L'vov was characterized by a predominance of Arctic air masses. It was determined that the Arctic air masses were extremely poor in microflora at all altitudes studied. The picutre changed markedly when the Arctic air masses were transformed into air of the continental medium latitudes with a dividing front in the vicinity of L'vov; the number of microorganisms in the upper layers of the atmosphere (from 100 to 6000 meters) increased mar edly, approximately three- to sixfold.

The degree of bacterial desperal in the upper air depends on the distance from a city.

According to average data, at a height of 500, 5000 and 6000 meters above a city there were 658, 196 and 62 microbes respectively per cubic meter of air while at a distance of 5-15 kilometers only 324, 168 and 67 bacteria per cubic meter of air while during the night more mocrobes were recovered from the upper air, as a rule, than during the day.

It was however pointed out that the microflora of the upper layers of the atmosphere were much less rich in pugmented varieties in the winter and particularly in the mold fungi. While, for example, during the summer and autumn the proportion of the latter at an altitude of 250 meters was 16.4% of all the microflora recovered, and at an altitude of 7000 meters 76.2%, in the winter at these same altitudes it was only 4.4 and 11.6% respectively. The coccal forms were recovered much less frequently from the upper air. But the spore-bearing species, and some species of fungi, were detected in considerable quantities.

In 46 air samples the hemolytic cocci did not produce any growth. And no anaerobes were recovered from 87 air samples taken at different altitudes.

The thermophils however were recovered in 9 cases out of 80 (11.2%) in the amount of 14-30 colonies per cubic meter of air.

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